

THE MONONGAHELA SOUTH NO. 1 DANGEROUS HIGHWALL RECLAMATION PROJECT, CITY OF MONONGAHELA, PENNSYLVANIA₁

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Abstract. The Pennsylvania Abandoned Mine Land Program completed the Monongahela South project in 2005. The project involved the stabilization of a dangerous and deteriorating highwall that threatened a church and school in the City of Monongahela, Washington County. A portion of the highwall was stabilized by cutting the slope back and included the incidental extraction of coal. Construction of a soldier pile and lagging retaining wall stabilized the remainder of the highwall. The highwall was typically 40 feet high and the hillside immediately above the highwall was very steep with residential streets and homes located just above the top of the slope. Differential weathering on the exposed highwall had caused treacherous rock overhangs that eventually would break off and fall onto the driveway located behind the church and school. Several automobiles were severely damaged by rock falls from the highwall during church services. The school at the site had been closed for several years due to the dangerous condition posed by the highwall.

Additional Key Words: incidental coal extraction, soldier pile and lagging retaining wall, slope reduction.

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Introduction

Coal mining and steel making are two industries that have formed the backbone of the economy in western Pennsylvania for over one hundred years. The primary coal seam mined for production of coke used in the steel making industry was the Pittsburgh Coal Seam. The Pittsburgh Coal Seam outcropped along the hills that formed the banks of the Monongahela River, and the coal, once mined, was moved down river on large coal barges for use in the steel mills near Pittsburgh. As coal mines were developed, small mining communities began to spring up along the shores of the Monongahela to supply workers for the mines and mills. As the communities grew, flat or gently sloping land became a valuable commodity. So in 1950, when the Diocese of Pittsburgh acquired a strip-mined tract on a steep slope in the City of Monongahela, the parishioners of St. Anthony's Parish were ecstatic about having enough flat ground on the bench of the abandoned surface mine to construct a new church, parochial school and parish house. This hillside had a storied history as the famous Whiskey Rebellion (the first test of the power of the newly formed United States government as it related to collecting a tax on whiskey) took place only a short distance to the east on this very hillside in 1794.

Construction of the church was completed in 1952, and construction of the school was completed shortly thereafter in 1954. The 40-foot, near vertical highwall adjacent to the new church and school seemed very competent and stable at that time. As the years passed, natural weathering of the exposed rock face of the highwall began to cause more and more problems for the church and its members. Several rock falls from the highwall damaged vehicles and resulted in an Office of Surface Mining (OSM) emergency project to seal a mine entry that opened due to the collapse of material from the highwall. In the 1990s, the Diocese was forced to close the school because of safety concerns due to the unstable and hazardous highwall.

As a result of the hazardous abandoned mine land (AML) features at the site, the Pennsylvania Department of Environmental Protection (PA-DEP), Bureau of Abandoned Mine Reclamation (BAMR), completed a unique reclamation project during 2004-2005. The project involved the stabilization of the deteriorating highwall that threatened the parishioners of St. Anthony's Roman Catholic Church. The eastern two-thirds (2/3) of the highwall was stabilized by cutting the slope back to a stable slope. The western one-third (1/3) of the highwall was stabilized by constructing a soldier pile and lagging retaining wall. The highwall could not be cut back in this area due to residential properties and a city street located at the top of the slope.

Description of the Site and AML Problem

The Monongahela South No. 1 site is located in the City of Monongahela approximately 500 feet west of Main Street. The site is on the hillside on the north side of Park Avenue, adjacent to St. Anthony's Church and School. The site consisted of a deteriorating highwall approximately 800 feet long, which ran

along a driveway next to the church, parochial school, and a parish house. The highwall was typically 40 feet high with the following profile from bottom to top: approximately six feet of Pittsburgh coal; approximately 20 feet of sandy shale; approximately three to four feet of sandstone; and a soil mantle that varied in thickness. The hillside immediately above the highwall was very steep (approximately 1H:1V) with residential streets and homes located immediately at the top of the slope. Figure 1 shows the location of the highwall, church, parochial school, parish house, and other pertinent cultural features at the project site. The project site is included in AML Problem Area PA3803.

Differential weathering on the exposed highwall had caused the more competent sandstone layer near the top of the highwall to jut out from the less resistant underlying shale causing treacherous overhangs. A number of these overhangs eventually broke off and fell onto the driveway located behind the church and school. Several automobiles were severely damaged by rock falls from the highwall during church services. The school at the site had been closed for several years due to the dangerous condition posed by the highwall. In addition to the danger of falling rock the highwall posed to pedestrians and automobiles traveling along the driveway at the base, individuals walking along the top of the highwall were at risk of falling off the cliff.

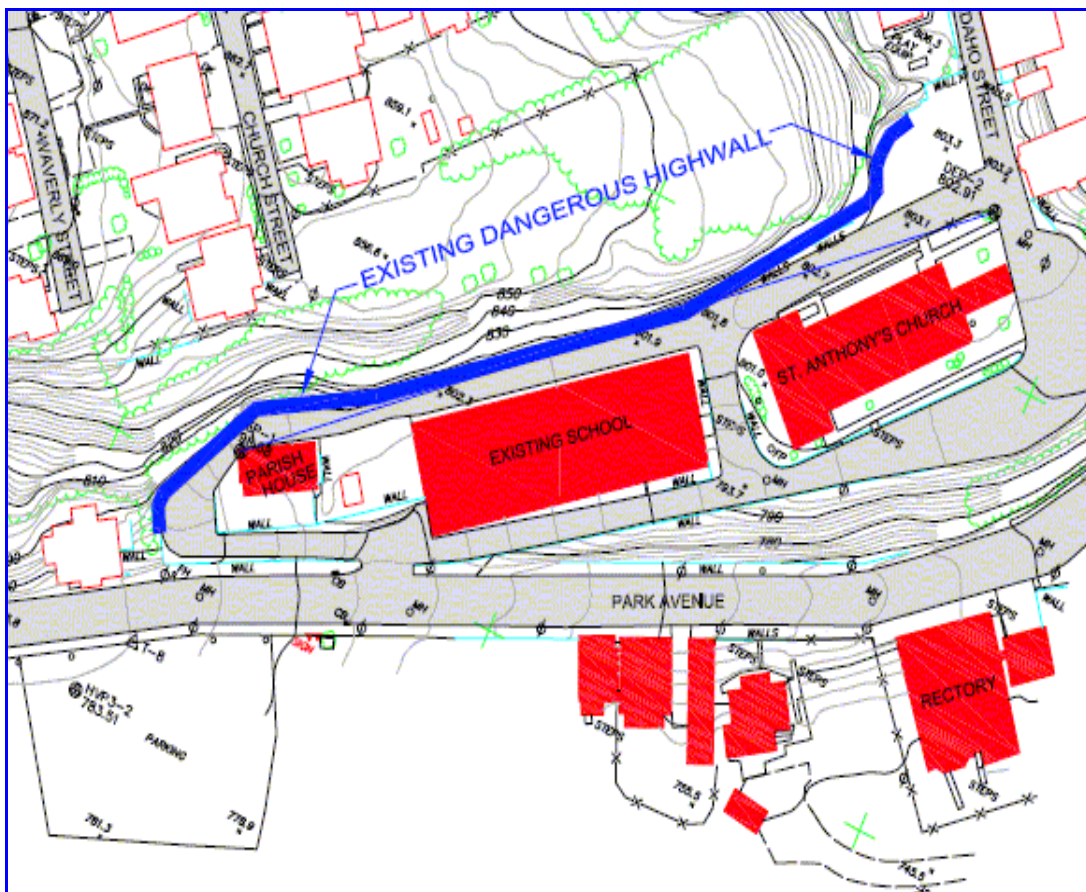


Figure 1. Project Site Plan.

Now that all reclamation work is completed, St. Anthony's Parish plans to reopen the school. A secondary benefit for the parish of cutting the highwall back was the widening of the driveway next to the church to provide an additional parking area. Figures 2 and 3 show photographs of the dangerous highwall prior to the reclamation project.

Mining History

The dangerous highwall at the site was created by surface mining conducted by Ripeppi Coal Company on the Pittsburgh Coal Seam between 1945 and 1947. The coal seam averaged about eight feet (8') thick and was characterized as high Btu, low sulfur and low ash. The mine openings located at the base of the highwall were created by underground mining operations conducted by the Chamber Brothers Coal Company, Crall Pit Mine during the early 1900s. No detailed mine map showing the extent of workings was located for use in developing and designing the reclamation project.

Project Design Challenges

The development and design of the reclamation project presented many challenges. A review of pre-reclamation site conditions and other background data resulted in the identification of the following key issues. These issues required careful evaluation in developing the final highwall reclamation plan:

- Safety (for the contractor's employees and the general public).
- Long-term stability and reliability of the reclamation method.
- Construction and maintenance costs.
- Accommodating the long-range plans of the parish.
- Maintaining normal operation of the church during construction.
- Disposal of excess spoil material.
- Incidental coal extraction.
- Sealing abandoned mine openings located at the base of the highwall.
- Management of both storm runoff and mine drainage.
- Consideration of potential mine subsidence issues/problems.
- Constructability of recommended reclamation method.
- Working in an urban environment.
- Impacts on nearby residential properties.
- Permitting and approvals.



Figure 2. Dangerous highwall looking west with the church, school and parish house visible on left.



Figure 3. Dangerous highwall looking east with the school and church on right.

Design Summary

In June 2002, the PA-DEP-BAMR entered into a contract with GAI Consultants, Inc. (GAI) of Pittsburgh, PA to complete the design of a reclamation project for the site. The design work was divided into two phases. The first phase was an analysis of selected reclamation options. For each option the design team evaluated estimated project costs, advantages and disadvantages, and assessed its constructability. The analysis of alternatives was completed in October 2002 at a cost of \$24,860. The second phase of the work was the completion of a detailed design of the recommended alternative. GAI was awarded the contract for this phase in November 2002. The final design, including project plans, specifications and permits, was completed in March 2003 at a cost of \$68,423.

The project was originally advertised for bids in April 2003. A bid opening was held in May 2003, but all bids were rejected, as the low bid was much higher than the engineer's estimate of \$923,000. A meeting with the prospective contractors was held on site in July 2003 to discuss issues that were causing the bid prices to be high. As a result of input received from prospective contractors, the bid documents were modified and the project was again advertised for bids in July 2003. Bids were opened in August 2003 and a contract was awarded to Alex E. Paris Contracting, Inc. of Atlasburg, PA in November 2003 at the low bid price of \$1,249,826. The pre-job conference for the project was held on December 5, 2003, and construction began shortly thereafter.

As a result of several issues that arose during construction of the project, a third contract with GAI was entered into in June 2004 at a cost of \$13,320. This third agreement brought the total cost of the consultant design for the project to \$106,603.

Construction Summary

Construction was initiated in December of 2003 and a final inspection for the project was held on July 14, 2005. Work on the project began with cutting the slope back starting at the eastern end of the highwall. Figure 4 shows the initiation of slope reduction excavation. The original design estimated that 22,600 cubic yards of rock and soil would need to be excavated and disposed of to achieve the final grade. The actual quantity of rock and soil excavated and hauled to a spoil disposal area approximately one mile from the project site was 27,700 cubic yards. The cost of the additional excavation and disposal added approximately \$92,200 to the total contract amount.

The spoil disposal site was at a location where a sewer line installation project with a need for large quantities of fill material was underway. Spoil disposal was coordinated with the City of Monongahela and Carroll Township, the sponsors of the sewer line project. This coordination was beneficial for all parties involved, as removing and disposing of the excess fill from the project site was a major portion of the work at the project. Figure 5 shows an overview of the completed cut slope in relation to the church and school.



Figure 4. Initiation of the excavation work to reduce the slope of the highwall.

By cutting back the hillside to eliminate the vertical highwall, a block of Pittsburgh Coal was uncovered. Approximately 1,956 tons of coal were removed from the project site and sold. Figure 6 shows the coal removal operation during project construction. During excavation of the final cut slope, a number of underground mine workings were intercepted resulting in four standing mine openings at the base of the final slope. The design called for pneumatic stowing of the opening to block access followed by horizontal drilling of the exposed coal seam face with injection of a cement grout to stabilize the old mine workings and prevent future problems due to mine subsidence. However, before all of the openings were stowed and grouted, one of the larger openings in the middle of the project area collapsed. This necessitated a design change to construct a small retaining wall and to grout the strata above the opening. The cost of the remedial work to stabilize the collapsed area was about \$44,000.

The exposed coal seam face remaining at the base of the final cut slope was covered with steel mesh and grouted with a fiberglass-reinforced grout material. The final rock face of the finished cut slope was covered with a rock face support system comprised of wire mesh fencing anchored into rock along the hillside. Figure 7 shows the fiberglass-reinforced grout being applied to the coal seam face.



Figure 5. Finished cut slope with rock face support system adjacent to the school building.



Figure 6. Incidental coal extraction during project construction.



Figure 7. Fiberglass-reinforced grout being applied to the coal seam face.

In order to effectively route stormwater runoff from the project site, a new storm drain had to be installed and tied to the municipal stormwater system located along Park Avenue. The existing municipal system was undersized and in a state of disrepair, so the PA-DEP partnered with the City of Monongahela to upgrade the facilities along Park Avenue. A new culvert had to be installed under Park Avenue to effectively route the water to Pigeon Creek, and the PA-DEP contractor, Alex E. Paris Contracting, Inc, performed this work. A small volume of mine water also drained from the mine entries located at the base of the final cut slope, and a mine drainage collection and conveyance system had to be constructed to route this water away from the finished church parking area. Figure 8 shows the mine drain being constructed near the base of the finished cut slope.

At the western end of the highwall a soldier pile and lagging retaining wall had to be constructed due to the proximity of a house above the highwall. During construction, the contractor proposed a modified retaining wall design to alleviate construction safety concerns and to facilitate construction of the retaining wall in the very tight working conditions. The modified wall design was approved by the Department and resulted in a construction cost savings of approximately \$25,000. In order to ensure that the final slope above the retaining wall was stable, micropiles were installed near the top of the final cut slope in the vicinity of Church Street and the nearest occupied house.



Figure 8. Mine drain being constructed near the base of the finished cut slope.

The micropiles were not included in the original project design, and the cost to install the micropiles was approximately \$104,000. In addition, a five-foot high security fence was installed along the top of the entire length of the finished cut slope. Figure 9 shows the retaining wall under construction, and Figure 10 shows the finished retaining wall and rock face support system near the west end of project site.

Finally, to protect the area below the finished cut slope, a drop zone was established and a Jersey barrier wall was constructed to create an area for any rock or other material from the rock face to drop without threatening the parishioners or their vehicles. The expanded church parking area was stabilized with AASHTO 57 stone.

On July 6, 2005, a media event was held to showcase the project to the general public. Many parishioners attended to express their gratitude for the project. Mr. Ernest Gross, a lifelong member of the parish, had been working since 1985 to find a solution to this hazardous condition and was ecstatic about how the final project turned out. Mr. Paul Iurlano, property manager for the Diocese of Pittsburgh, also lauded the PA-DEP's efforts to reclaim the site. Father Joseph Feltz of St. Anthony's Parish expressed his deepest appreciation for the project. He indicated that the church plans to pave the parking area in the spring of 2006 and intended to take steps to put the school back in service. The church has already begun using the parochial school building to hold Sunday school classes. Figure 11 shows the finished project from above the reclaimed highwall with the church and school in the background.



Figure 9. Soldier pile and lagging retaining wall under construction.



Figure 10. Completed retaining wall at west end of project site - the school is just visible on the right edge of photograph.

Project Summary

The Monongahela South No. 1 project eliminated an 800-foot long dangerous highwall that presented a severe health and safety hazard for the members of St. Anthony's Roman Catholic Church in Monongahela. The highwall averaged 40 feet high and, due to weathering of the exposed highwall face, was extremely unstable. The highwall also posed a hazard to persons living in residential properties and walking the city streets that were located immediately above the top of the highwall. The project was designed by GAI Consultants, Inc. and constructed by Alex E. Paris Contracting, Inc. The final project cost was \$1,457,925.57. Because of the many buildings and roads in the immediate proximity of the highwall, reclamation options were limited. The ultimate reclamation plan incorporated the needs and interests of many people and groups, and the completed project showcases the kind of exemplary reclamation that can be accomplished by the AML Program.



Figure 11. Reclaimed site from above with the school and church in background.

References

Problem Area PA3803, Monongahela South No. 1. 1985-2006. Project development, project design and project construction files, internal files, Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation.